The period of Neo-Darwinism and Population Genetics (1908-1930)

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Exercise 1 (home group, individual work):

Read the following text carefully. Your task is to fill in the missing words and phrases, which you know from your biology lessons. If you need help, you can...

- ...go back in the text **or**
- ...read further.

If you have problems understanding the text, write down your questions!

In the early 20th century, the integration of Mendelism and Darwinism started. The rediscovery of Mendel's laws around 1900 displaced the theory of natural selection by Charles Darwin. In 1908, **Godfrey H. Hardy** and **Wilhelm R. Weinberg** established the basis for this important integration of theories independent of each other.

In 1908, Hardy attended a conference, at which the frequency of recessive characters was discussed. The scientist Yule stated that recessive factors (today better known as alleles) will disappear in the course of a few generations even if natural selection is absent because dominant factors (alleles) will establish themselves at any rate. Hardy disagreed with Yule's statement, but he was not able to disprove it. He was quite unhappy about this. In the same year, he managed to develop a mathematical formula (see fig. 1). It says that allele frequencies in "ideal populations", which means in the absence of factors like selection or mutation, will remain constant by means of random recombination (see example in fig. 1). This principle was later called the _____ distribution.

$$p^2 + 2pq + q^2 = 1$$

frequency of genotype BB	frequency of genotypes Bb and bB	frequency of genotype bb

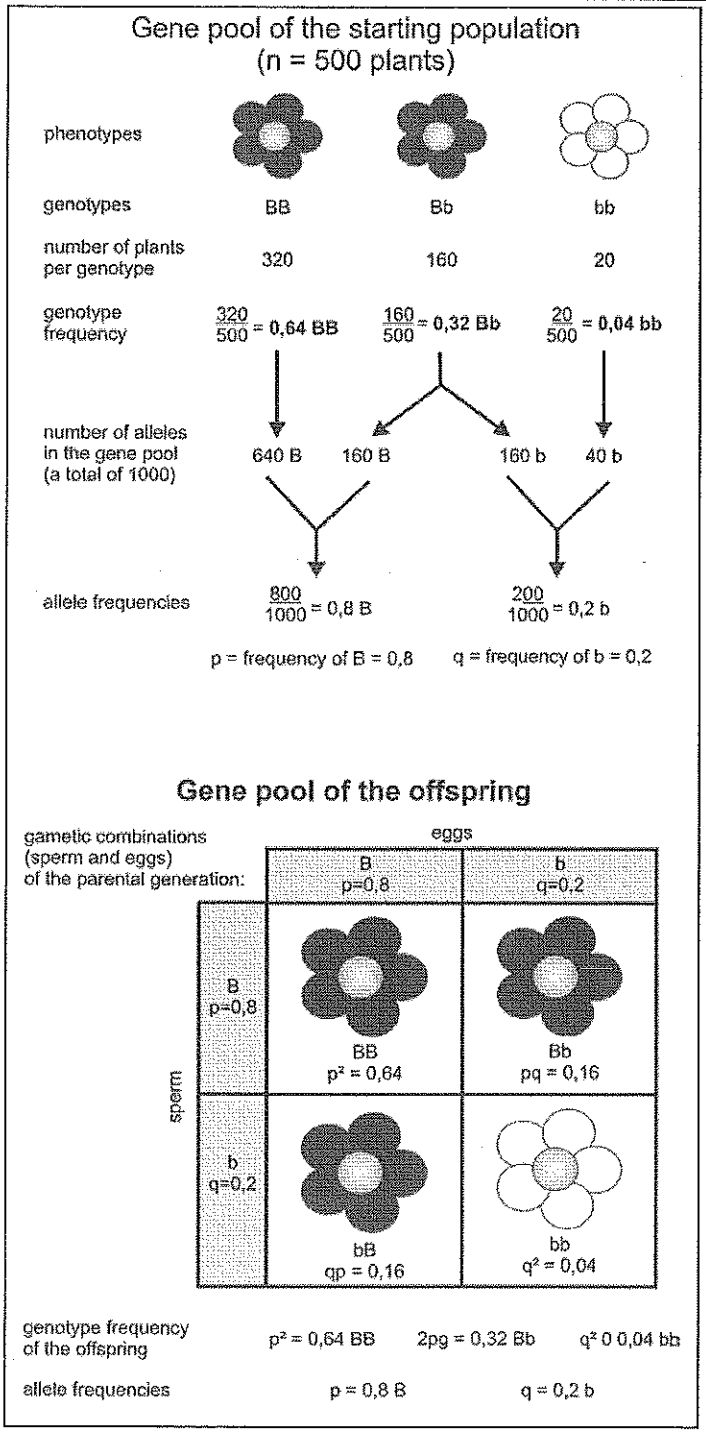

Fig. 1: Example of use for the formula of Hardy and Weinberg.

Two years later, **Thomas H. Morgan** and his team studied the inheritance of white eyes in *Drosophila* (fig. 2). The team discovered that _____ are responsible for the inheritance. But soon a problem occurred: there were more character states than chromosomes. Thomas H. Morgan did further research and succeeded in solving the problem. The solution consisted in _____. Thomas Morgan had to define them exactly because until then they were simply known as "units of heredity".

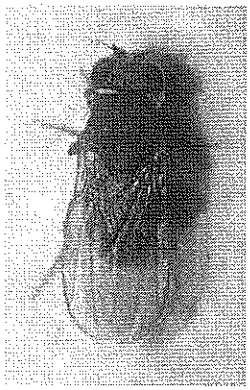

Fig. 2: Drosophila with red eyes.

In 1928, the scientist **Frederick Griffith** investigated the bacterium *Streptococcus pneumoniae*, which causes pneumonia in mammals. He worked with two different strains. The so-called S-strain (S means smooth) of the bacterium *Streptococcus pneumoniae* is characterized by a mucic capsule, which surrounds two connected cells. The other so-called R-strain (R means rough) has no mucic capsule. Griffith was surprised that he was able to obtain living pathogenic cells from the dead mice in experiment 4. The mice had obtained a mixture of pathogenic cells killed by using heat and living harmless cells (fig. 3). Griffith concluded that some chemical substance from the pathogenic cells had changed (transformed) the harmless cells. Thus, Griffith discovered the phenomenon of _____.

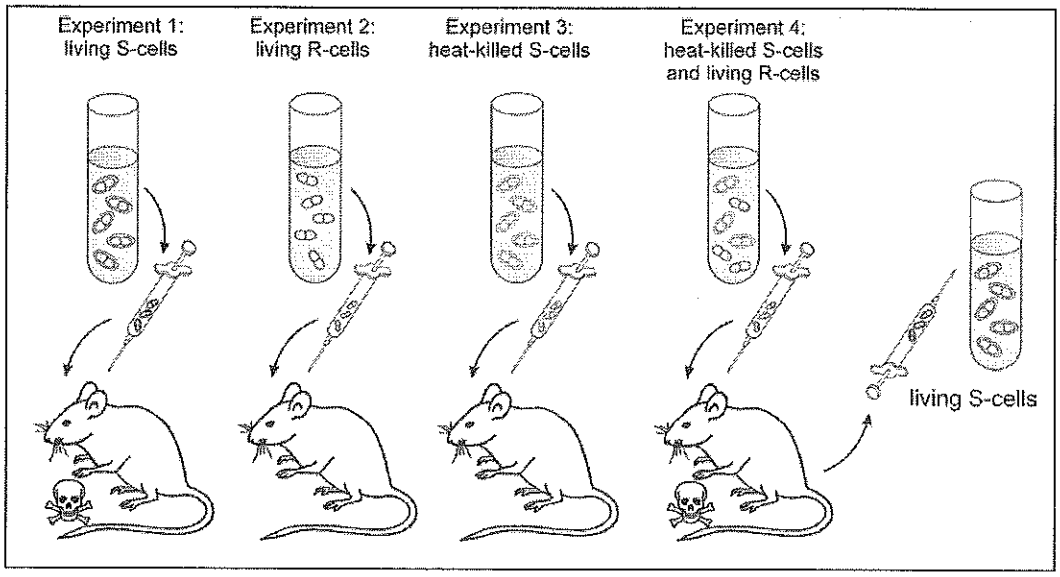

Fig. 3: Frederick Griffith's experiment. He drew his conclusions from experiment 4.

Sixteen years later, in the year 1944, **Oswald T. Avery** continued the experiment from Griffith. Avery succeeded in identifying the mysterious chemical substance, which transformed the harmless cells into pathogenic cells in the 4th experiment. He discovered the mysterious molecule responsible for inheritance: _____. He made this discovery by relating his experiments to already existing findings of Frederick Griffith.

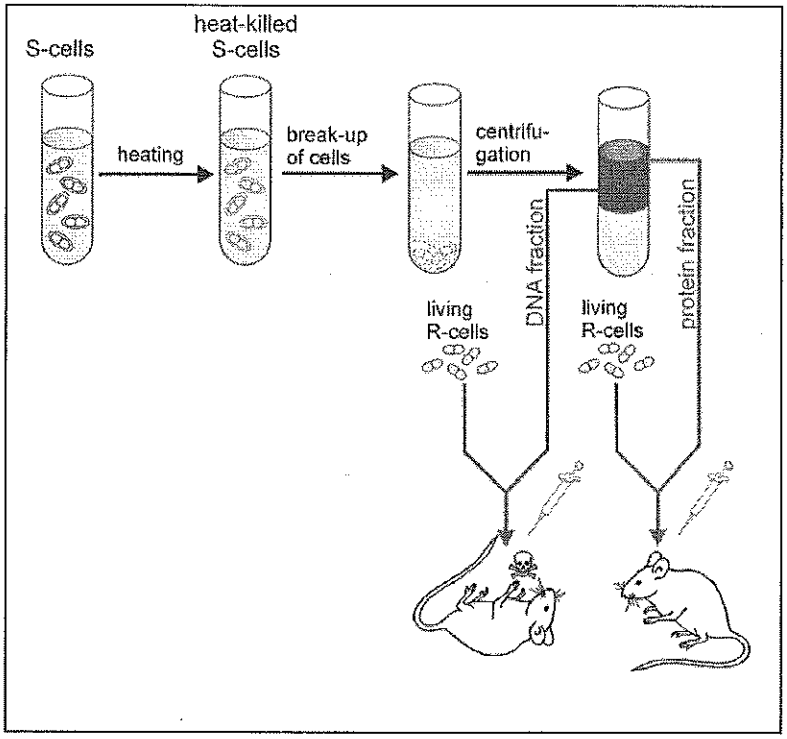

Fig. 4: The experiment from Oswald T. Avery. He related his experiments to the findings of Frederick Griffith from the year 1928.

Exercise 2 (expert group, teamwork)

Check your cloze texts and your reading comprehension for correctness. Subsequently answer the following questions:

a) Imagine you are Godfrey Hardy and would like to persuade scientists like Yule that recessive and dominant alleles alone do not trigger evolution. Interpret figure 1 in order to support your argumentation.

b) How did Thomas H. Morgan solve the problem that there are more character states than chromosomes?

c) Describe Frederick Griffith's experiments. What happened in experiment 4 (fig. 3) so that the R-cells killed the mice?

d) Using figure 4, explain, how Oswald T. Avery discovered the mysterious molecule of inheritance.

Exercise 3 (expert group, individual work)

Copy the terms you filled into the gaps of the cloze text (everything that is underlined) onto the 'milestone-cards' (see last page of the material). There is one card for each milestone from the period of population genetics.

Exercise 4 (home group, teamwork):

Each of you is asked to present the milestones of his/her period to the other team members by attaching the milestone-cards chronologically to the time bar. The expert for the period of Darwinism starts. For each milestone-card the expert explains, which person arrived at which insight by which means and how the insight changed evolutionary theory. Afterwards, the next expert follows until the time bar is completed.

Exercise 5 (home group, teamwork):

After completing the time bar, your team creates a concept map with as many connections as possible.

1.) Choose at least 12 milestones from the time bar (each period should be included).

2.) Write down the term from each milestone on a piece of paper.

3.) Arrange the pieces on a blank sheet so that the milestones which have a close connection lie close to each other. Consider what kind of relationship exists between the different milestones.

The following advices my help you:

The relation between two terms can be that …

… one term is an example of the other term (i.e.: mimicry is an example of natural selection).

… one term is part of the other term in the sense of a whole – part relationship (i.e.: chromosomes contain genes).

… terms are superordinate or subordinate concepts (i.e. mutation and selection are evolutionary factors).

4.) If you are satisfied with the arrangement of the milestones and the relations between them, glue the pieces of paper on the blank sheet.

5.) Now draw arrows between the terms.

6.) Describe the relationship above the arrows.